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(71) Applicant(s)

**NPF Limited**

(Incorporated in the United Kingdom)

Unit 10, Metro Triangle, 221 Mount Street, Nechells,  
BIRMINGHAM, B7 5QT, United Kingdom

(72) Inventor(s)

**John Ronald Rice**

**Nicholas John Marks**

(74) Agent and/or Address for Service

**Saunders & Dolleymore**

9 Rickmansworth Road, WATFORD, Herts, WD1 7HE,  
United Kingdom

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**F3C CFJ**

(56) Documents Cited

**GB 2290483 A**

**GB 2259559 A**

**US 5736720 A**

(58) Field of Search

UK CL (Edition R ) F3C CFJ CTE

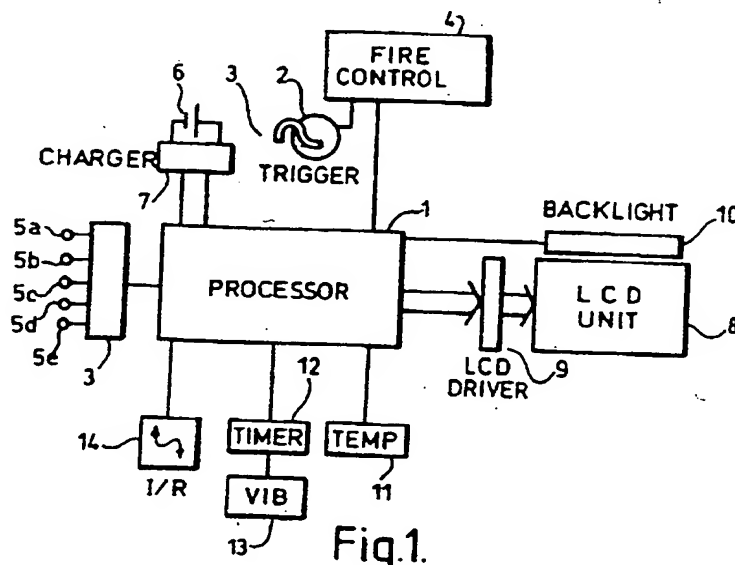
INT CL<sup>7</sup> F41A , F41B

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(54) Abstract Title

**Paintball guns**

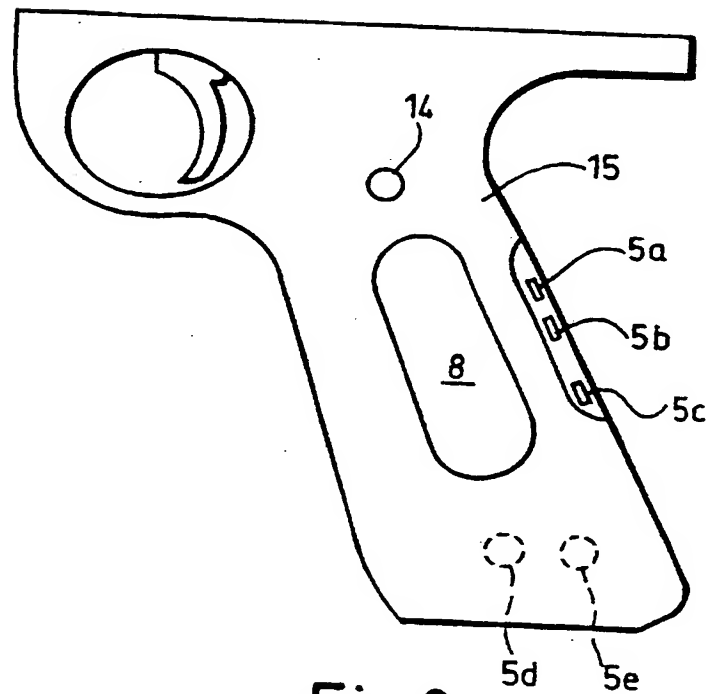
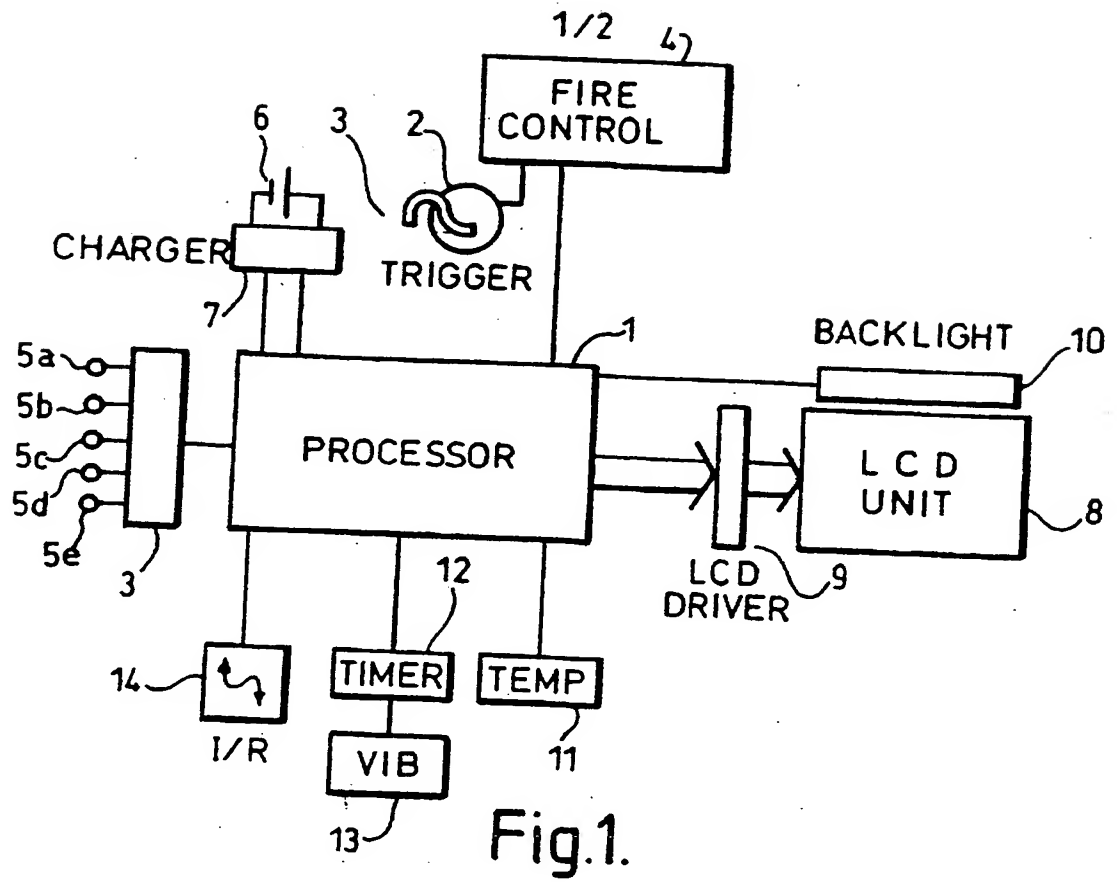
(57) An electronically controlled pneumatic paintball gun, comprising means (1) for monitoring and/or controlling one or more parameters of the gun's operation and alphanumeric display means for displaying data related to said monitoring or control on a display panel (8) integral with the gun.



**GB 2 342 710 A**

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

This print takes account of replacement documents submitted after the date of filing to enable the application to comply with the formal requirements of the Patents Rules 1995



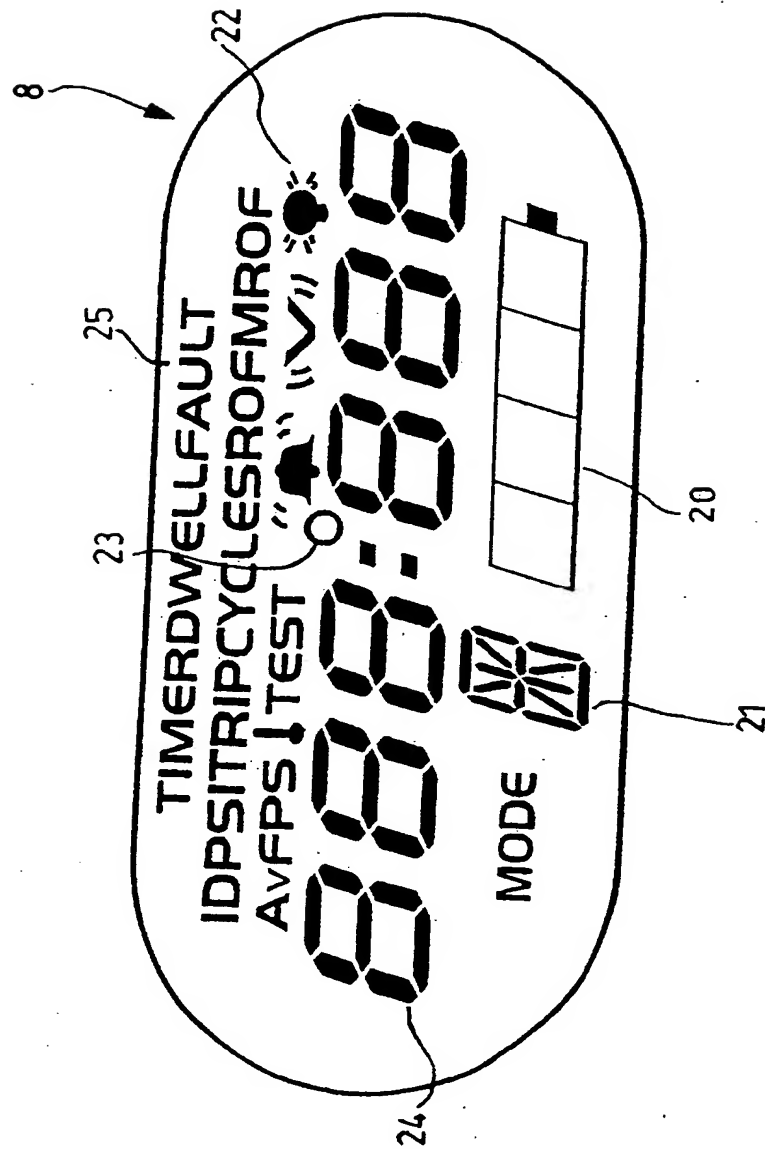


Fig.3.

PAINTBALL GUNS

This invention relates to paintball guns.

5       The game of paintball involves participants carrying guns which fire pellets of 'paint' or dye which are fired from the gun and burst upon impact to leave a mark at the point of impact.

10       Most paintball guns use a pneumatic system for firing the paintballs using compressed air or other gas. More recently, such pneumatically operated guns have begun to be electronically controlled for greater effectiveness.

15       According to the present invention there is provided an electronically controlled pneumatic paintball gun, comprising means for monitoring and/or controlling one or more parameters of the gun's operation and alphanumeric means for displaying data related to said monitoring or control on a display panel integral with the gun.

The display panel is most preferably mounted on the cheek of the gun.

20       Embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 shows schematically an electronic apparatus for use in a paintball gun;

Figure 2 shows the handle of a gun; and

25       Figure 3 shows a display.

30       A paintball gun embodying the present invention uses a compressed gas circuit supplied with gas from a gas cylinder to eject projectiles in the form of spheres containing paint which break upon impact. The gun is electronically controlled, typically by a microswitch operated upon by a trigger squeezed by a user's finger and the electronics

control the firing mechanism and in particular ensure correct timing. The electronics also enable various different modes of firing, such as a semi-automatic mode in which each trigger actuation causes a projectile to be fired, typically up to 20 times a second, or a fully automatic mode in which a single trigger actuation causes a burst of a selectable number of  
5 shots. Other parameters such as dwell time, firing rate, number of bursts per second, and so on are also selectable under the operation of the control electronics. A paintball gun of this type is commercially available as the Angel™ gun manufactured by NPF Limited and reference is made to US Patent Application No 09/137,641.

10 Figure 1 shows a control and display apparatus for use in a gun according to the present invention. The apparatus comprises a central processor 1 which typically includes a microprocessor. As described, operation of the gun is initiated by a user depressing a trigger 2 which acts upon a microswitch in known manner. This sends an appropriate signal to fire control/monitoring circuitry 4, which may be at least partially incorporated in  
15 the control unit 1 and which can be used to control the rate of fire, dwell time, etc, and also to fire the gun when the trigger has been operated, using the mode designated by the user. These modes may be, for example, manual, semi-automatic or automatic modes or other modes as required or as allowed by the rules of the particular event or tournament he is playing in. These operate in known manner.

20

A plurality of input buttons 5a to 5e are arranged to provide user input to the processor 1 via a user interface 3 and these have several different functions as will be outlined below.

25

The gun is powered by a battery 6 which is preferably a rechargeable type and which can charge through a battery charger 7 which has a mains input.

An integral alphanumeric display unit in the form of an LCD unit 8, driven by an LCD driver circuit 9 is connected to the processor and this displays various types of data  
30 and information. Preferably, a back-light 10 is also provided to enable better viewing of the

LCD unit but which back-light may be turned off when required. The alphanumeric display need not necessarily be an LCD display.

Various other pieces of apparatus, sensors, etc, may be added to the control unit and non-limiting examples of these are shown in Figure 1. There is shown a temperature sensor 11, a timer 12 and a vibrator 13. The timer 12 can be used for various purposes such as for timing a paintball game and for an alarm function and the vibrator 13 may be used as the alarm indicator for the timer 12. In addition, an infrared link 14 is provided which enables programming of the control unit, or by directional data exchange, to take place from a remote PC or other device fitted with a similar infrared unit. Infrared communication devices are well known. A serial link, e.g. RS232C, or other communications link may also be provided.

Figure 2 shows the grip frame part of a paintball gun. The user holds the grip in the normal manner and squeezes the trigger 2 to fire the gun. As shown, the gun is radically different from previous paintball gun designs in that an LCD display 8 is integral with and incorporated into the gun, in this case on the cheek of the grip frame 15. It could, however, be mounted in any other position/disposition on the gun itself. The control buttons are also distributed on the grip frame. Three of the buttons 5a, 5b and 5c are mounted in a recessed portion where they are always accessible. The remaining buttons in this embodiment are mounted under a cheek plate (not shown) which is screwed or otherwise attached over the cheek, possibly using anti-tamper means, or tamper-indicating means such as seals, and thus are only accessible when the plate is removed. This is because these buttons are used, as described below, to alter various functions of the gun which affect its performance, rate of fire, etc. In many events, the rate of fire or other gun parameters must be set before the game begins and cannot be altered once the match is underway. By being mounted in an inaccessible position, these buttons achieve this objective.

The various functions alterable and displayable on display 8 are as follows:

Various values and words are selectably displayed by a six character alphanumeric display 24 and a plurality of fixed words/characters which are illuminated as required. A battery indicator 20 is displayed at all times and goes from blank to full (all four segments displayed). When down to about 25% power level the last segment only is displayed, and this flashes indicating low power status.

A mode indicator 21 displays the mode of firing and may show single characters or numerals such as A, B, C, 1, 2, 3 etc. Modes are displayed at all times. The mode of firing can only be changed by one of the normally inaccessible tactile switches 5d or 5e. The modes available may be, for example, SEMI: (1 shot; 1 trigger pull), BURSTS: (a 3, 4, 5, 6, 7 or 8 shot burst per trigger pull), ZIPS (3, 4, 5, 6, 7, 8 shot bursts at a rate of 8.75 shots/sec max). The MROF (Maximum Rate of Fire) function will display 8 when in the ZIP modes.

The vibrator may work in a timer mode for indicating, for example, 5 min intervals by actuating the vibrator for 3 secs. Note: if the 'V' mode is selected the 'V' is displayed on the LCD. Switching the vibratory alarm ON or OFF is selected from a sub-menu function.

Temperature may be displayed in °F or °C by the main alphanumeric display 24. A temperature icon is only displayed when the menu calls for it. Temp mode can be selected from the menu; Changing from Centigrade to Fahrenheit is selected from the sub-menu.

A trip meter is a shot counter that can be re-zeroed by the consumer. Trip can be selected from the menu. Resetting to zero is selected from the sub-menu.

A ROF (Rate of Fire) function may measure a string of shots over a selected (eg 1 second) period. The first shot starts the counter for 1 second, any shots that occur in that period are registered on the display. Then the display will not accept any input for a 3-second period. During this period the display will also flash before an additional cycle may start. The ROF mode can be selected from the menu. The data is constantly updated and

so no sub-menu is required.

The display can accordingly display not only a desired rate of fire, but also the rate of fire actually achieved by the user, which can fall well short of the desired rate of fire, or could even exceed it for a very skilled marksman. Furthermore, competition rules may set an upper limit on the rate of fire, and this upper limit may be programmed in and displayed on the LCD display (MROF). More details are set out further below.

To power off the gun a tactile switch on the grip must be held for 1.5 seconds which shows the whole display for 2 seconds. Then the display shows the word "SAFE" and the back light switches OFF. The gun cannot fire in the safe mode but the battery meter is still displayed. An automatic power off function may be provided which powers off the gun if no shots are fired for a predetermined period, e.g. 60 minutes.

A unique ID number may be programmable into the gun by the manufacturers or suppliers. This number may affect, e.g. restrict, the modes it is possible for the gun to be fired in and can render the gun less likely to be stolen.

Numerous fault codes can be displayed, for example Fault 1, F1 = Over temp = 38°C, F2 = Under temp = 0°C, and so on. The fault can be selected from the menu. Should more than one fault be present the display will alternate at 2-sec cycles. The faults will only clear from the display when the fault condition is removed.

Dwell time may be displayed, e.g. in millisecs = e.g. 0:20 = 20ms. Dwell is changed via a tactile button and scrolls from 12ms to 25ms.

MROF displays the rate of fire as shots per sec, e.g. 12 = 12 shots/sec. MROF may be selected from the menu but can only be changed via one of the normally inaccessible tactile buttons on the board. In one embodiment the range is 5 to 20 shots per second.



**Note:** If a mode of fire has a preset rate this will be displayed under the MODE function and cannot be adjusted whilst in that mode.

A cycles counter is a grand total shot counter that cannot be reset by the consumer, only by the suppliers of the gun or other authorised person.

A TRIP counter is provided, which is a shot counter that can be zeroed by the user or consumer.

A timer is a countdown timer which can, for example, count down from 60 min. At the end of the count the vibrator alarm may be activated for 10 seconds. The timer can be set in 5-min increments, i.e. OFF, 5, 10, 15 etc. A sub-menu allows changes. The settings must remain in the memory even after power has been removed.

The display may also indicate test modes and a BACKLIGHT ON symbol 22 is included. Additional functions displayable include, inter alia, velocity, average velocity, gas pressure and gas usage, for example.

In one embodiment DWELL, MROF, MODE and TIMER functions are stored in non-volatile memory since these settings must be retained even when power is removed.

The button functions may be as follows in one embodiment.

**Button 5a**

Gun on/off when held for 1.5 seconds

Display "-live-" when on at all times unless timer started via activation to ready state via switch 4 and pulse vibrator for 3 seconds as confirmation. NOTE; menu switch 5b is inactive whenever the gun is in "-live-" or timer ready/timer active mode. NOTE timer can only be made active via switch 4. When in timer ready state the timer will show the set time and flash between "-live-" and set time at 1 second intervals. When gun is in the

5 “-live-“/timer ready status, timer starts when first shot is fired then the display will show the timer counting down. The arm will go off prior to time up. This feature allows the players to know when the game end is near and that they have a final opportunity to bring the game to a conclusion. Display “-safe-“ when off and switch 5b is now active and timer stops. Battery status to be displayed at all times; mode status to be displayed at all times even when “-safe-“.

**Button 5b**

10 Menus active only when the gun is “-safe-“. No access if the gun is “live”.  
FAULT – display “none” if no fault present  
ID – display unique ID number  
ROF – display the maximum rate of fire achieved measure between two shots  
TIMER – display set time  
VIBRATOR – display status  
15 LIGHTS – display status  
TEMP – display temperature  
CYCLES – display total cycles  
TRIP – display trip cycles

20 **Button 5c**

Sub menus note; no access if gun is in “-live-“ status. The timer is only available in “-live-“ status when switch 5c only puts timer in ready state, first shot will start the timer.

FAULT – “none” or “code 1”  
ID – no sub mode  
25 ROF – set to zero  
TIMER – from zero to sixty in five minute increments  
VIBRATOR – no sub menu  
Activate for two seconds  
LIGHTS – on/off  
30 TEMPERATURE – no sub menu

CYCLES – no sub menu

TRIP – reset to zero

**Button 5d**

- 5        No access granted if gun is in “-live-“ state. When switch 5d is pressed gun will go into “-safe-“ mode (gun cannot fire), then if no further button presses occur gun will display “-safe-“ after 5 seconds

**Menus**

- DWELL – display dwell time
- 10       MROF – display set rate of fire, NOTE; zip modes to show 9 enhanced modes to have maximum display of 13, semi mode to have maximum possible display of 20.
- MODE – display status, NOTE; mode can affect the MROF
- FAULT – display “none” if no fault present
- ID – display unique ID number
- 15       ROF – display the maximum rate of fire achieved measure between two shots
- TIMER – display set time
- VIBRATOR – display status
- LIGHTS – display status
- TEMP – display temperature
- 20       CYCLES – display total cycles
- TRIP – display trip cycles

**Button 5e**

- DWELL – scroll 10 to 24 milliseconds
- 25       MROF – display set rate of fire, NOTE; zip modes to show 9 enhanced modes to have maximum possible display of 2-13, semi mode to have maximum possible display of 2-20.
- MODE – A = auto, B = semi, C-I = burst modes, J-P = zip modes, R-T = ramp modes, U-Z = other modes. If no mode is allocated, then selected digit flashes and “no
- 30       Acc” is displayed. Also fault code “code 1” to be displayed. NOTE; mode can affect the

MROF, which must adjust accordingly, ie: last MROF setting in modes also to be retained when switching between modes. EG: semi set at 13 shots sec/mode B then mode F selected set at 12 shots/sec.

FAULT – no sub menu

5 ID – no sub menu

ROF – set to zero

TIMER – 0-60 minutes scrolled menu in 5 minute increments

VIBRATOR – On/Off

LIGHTS – On/Off

10 TEMP – F/C

CYCLES – no sub menu

TRIP – reset to zero

**Other features that are present in the preferred embodiment**

15 A. FACTORY RESETS - press and hold buttons 5 and 6 together for 1.5 seconds. Display all lights up. The values may be:

TRIP – 000

FAULTS – status

ID – status

20 ROF – 0

TIMER – 15 minutes

MODE – B (semi)

MROF – zips at 9 semi at 11 all enhanced at 11

DWELL – 14

25 VIBRATOR – on

LIGHTS – off

TEMP – f

Cycles – status

30 B. The hopper system can be controlled via the gun to suit different parameters

ie hopper in semi mode switched on when a rate of 2 shots/second are achieved. In all other modes hopper to switch on after first shot.

- 5           C.       Codes are used to allow access to certain parameters of the gun, which one  
              may not wish the consumer to have access to. IE: RS232/infrared link to have a code word  
              which will give access to setting the ID number and resetting the CYCLES. Link remains  
              connected for this operation. Menu on the screen hyperlink. RS232/infrared link may have  
              a further code word which will give access to override the lock out status on the internal  
              menus ie the internal menus can be worked on for 1 hour with the gun "live" then lockout  
10           reactivates, this countdown stating when the RS232 link is removed. This is required so the  
              guns can be set up in assembly.

              D.       Power saving feature, ie Electronic Sleep occurs after 10 hours.

- 15           E.       Should the battery be disconnected when reconnected the gun comes on in  
              "-safe-" mode.

              F.       The power source is a rechargeable battery that can be recharged without  
              removal from the gun.

CLAIMS

1. An electronically controlled pneumatic paintball gun, comprising means for monitoring and/or controlling one or more parameters of the gun's operation and an  
5 alphanumeric display for displaying data related to said monitoring or control on a display panel integral with the gun.
2. A paintball gun as claimed in Claim 1, wherein the display panel is provided on a  
10 cheek of the grip frame of the gun.
3. A paintball gun as claimed in Claim 1 or Claim 2, including a processor and at least one input or detector connected to the processor.
4. A paintball gun as claimed in Claim 1 or Claim 2, comprising timing means.  
15
5. A paintball gun as claimed in Claim 4, including an alert means.
6. A paintball gun as claimed in Claim 5, wherein the alert means comprises an audible device or vibrator.  
20
7. A paintball gun as claimed in any preceding claim, wherein the actual and/or maximum rates of fire of the gun are displayable.
8. A paintball gun as claimed in any preceding claim, wherein the means for  
25 monitoring and/or controlling comprise any one or more of a temperature sensor, gas pressure sensor, timer, gun control means, means for detecting, incrementing and/or decrementing parameters related to actual shots fired, battery charge sensor, dwell time controller, gas velocity sensor, or temperature sensor and data representative of any one or more of these is displayable.  
30

9. A paintball gun as claimed in any preceding claim, including a plurality of control input buttons, at least one of which is provided in a normally inaccessible position.
10. A paintball gun as claimed in Claim 9, wherein said at least one button is located  
5 behind a plate which requires detaching to gain access to the button.
11. A paintball gun as claimed in Claim 10, including anti-tamper or tamper-evident means.
- 10 12. A paintball gun as claimed in any preceding claim, wherein the display means is an LCD panel.
13. A paintball gun as claimed in any preceding claim, including a means for communication with an external unit.
- 15 14. A paintball gun as claimed in Claim 12, wherein the communication means comprises an infra-red means.
15. A paintball gun substantially as hereinbefore described with reference to, and as  
20 illustrated by, the accompanying drawings.



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INVESTOR IN PEOPLE

Application No: GB 9916688.6  
Claims searched: 1 to 15

Examiner: Trevor Berry  
Date of search: 9 March 2000

## Patents Act 1977 Search Report under Section 17

### Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK CI (Ed.R): F3C (CFJ, CTE)

Int CI (Ed.7): F41A, F41B

Other: ONLINE: EPODOC, JAPIO, WPI

### Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	GB 2290483 A ECLIPSE CONCEPTS-see display 24/30 in figure 2.	1 at least
X	GB 2259559 A WATKINS-see page 7 lines 12 to 20	1 at least
X	US 5736720 BELL-see figures 2 to 4	1 at least

X Document indicating lack of novelty or inventive step  
Y Document indicating lack of inventive step if combined with one or more other documents of same category.

& Member of the same patent family

A Document indicating technological background and/or state of the art.  
P Document published on or after the declared priority date but before the filing date of this invention.  
E Patent document published on or after, but with priority date earlier than, the filing date of this application.